Estimating True Turbulence Spectrum via MST Radar Observation

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Estimating the shape of the turbulence spectrum has been one of the major interests in the atmospheric observation using wind profiler or mesosphere-stratosphere-troposphere (MST) radars. Since the atmospheric turbulence has a spatial structure and time evolution in nature, its spectrum is four-dimensional. The atmosphere translates in time while the radar is fix to the ground, the space and time of the spectrum are mixed in the observed radar echo. Historically, the spectrum observed by a radar has been assumed or supposed to be a Gaussian. We reconsider the persistent assumption from a theoretical point of view in this study. In addition to the underlying turbulence spectrum, radar observation itself affects the observed turbulent echo through the spatial structure of the transmission and reception antenna beams. This effect is well known as *beam broadening* and has been taken into accound in the process of analysis of the observed data in an approxmated manner. PANSY radar, the MST radar we operate in Syowa station, has a scattered antenna array with an aperture filling factor of around 0.3. For this unique radar, it is crucial to eliminate the beam broadening effect to estimate the turbulence spectrum. In this presentation, we talk about the quest for the turbulence spectrum.